NEW MEXICO ENVIRONMENT DEPARTMENT
GROUND WATER QUALITY BUREAU

UNDERGROUND INJECTION CONTROL

GENERAL DISCHARGE PERMIT

Certified Mail- Return Receipt Requested

Facility Name:	**Kirtland Air Force Base – Site UST #58 (PL-567)**
Facility Location:	**2050 Wyoming Boulevard SE** **Kirtland AFB, New Mexico 87117-5270** **Section 32, Township 10N, Range 4E** **Bernalillo County**
Legally Responsible Party:	**David S. Miller, Colonel, USAF** **Commander, 377th Air Base Wing** **2000 Wyoming Boulevard SE** **Kirtland AFB, New Mexico 87117**
Point of Contact:	**Scott Clark, Restoration Program Manager** **377 MSG/CEI** **2050 Wyoming Blvd SE** **Kirtland AFB, NM 87117-5270** **Ph: 505-846-9017**
Remediation Oversight Agency Contact:	**Jim Gibb, Geoscientist Supervisor** **NMED/Petroleum Storage Tank Bureau** **2905 Rodeo Park Drive East, Bldg 1** **Santa FE, NM 87505** **Ph: 505 476-4387**
Remediation or Injection Plan Identification:	**PL-567 Underground Storage Tank 58, Pilot Test Work Plan, Revision 2** **April 2019**
Permitting Action:	**New**
PPS Contact	**Scott Clark, Restoration Program Manager** **505-846-9017**

EFFECTIVE DATE: XX/XX/XXX **TERM ENDS:** XX/XX/XXXX

Michelle Hunter
Chief, Ground Water Quality Bureau

[Subsection H of 20.6.2.3109 NMAC, NMSA 1978, § 74-6-5.I]

I. UIC GENERAL DISCHARGE PERMIT

The New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) issues this Underground Injection Control General Discharge Permit (UIC Permit) for the subsurface emplacement of additive fluids through a Class V UIC injection well for the purpose of facilitating vadose zone or ground water remediation. The GWQB issues this UIC Permit to Kirtland Air Force Base (Permittee) pursuant to the New Mexico Water Quality Act (WQA), NMSA 1978 §§74-6-1 through 74-6-17, and the New Mexico Water Quality Control Commission (WQCC) Ground and Surface Water Protection Regulations, 20.6.2 NMAC.

In issuing this UIC Permit, the GWQB has determined that the requirements of Subsection C of 20.6.2.3109 NMAC have been met. The activities authorized by this UIC Permit are principally governed by PL-567 Underground Storage Tank 58, Pilot Test Work Plan, Revision 2 (Injection Plan), under the authority of STATUTES/REGULATIONS, with oversight by the NMED/Petroleum Storage Tank Bureau. Compliance with this UIC Permit requires compliance with the terms, requirements, and conditions of the Injection Plan. The term of this UIC Permit shall be no longer than five years from the effective date of this UIC Permit.

The injection activities, the location of the injection site, the type of injection and quantities of additives being used are briefly described as follows:

Injection Activities (summary: including injection well type, number of wells, and injection frequency)

Copy of the Injection Plan Attached (required): ☐

The primary activities that will be performed for this pilot test include surfactant and clean water injections, with extraction of groundwater and phase separated hydrocarbon, followed by injections for in-situ chemical oxidation to address any residual contamination in the groundwater at the PL-567 site at Kirtland Air Force Base (AFB). Baseline and performance groundwater monitoring will be conducted before, during and after the pilot test.

Site PL-567 (UST Site #58) is located within the security fence of the former Manzano Weapons Storage Area, approximately 5.8 miles southeast of the Wyoming Blvd Kirtland Air Force Base entrance gate. The Site is located east of the Sandia and Tijeras faults, and geology is characterized as a granite bedrock 'bowl' shaped feature overlain by fractured bedrock and sedimentary deposits. Groundwater in this location is not in the regional alluvial aquifer (Rio Grande deposits) that is used for municipal pumping operations at Kirtland or by the City of Albuquerque. The Site is estimated to be approximately 2 miles east of the nearest pumping wells (KAFB #4) 100-year capture zone (i.e., the extent of groundwater that will reach well KAFB#4 within the next 100 years), and over 3 miles southeast of the nearest City of Albuquerque municipal well's (Ridgecrest 3) 100-year capture zone (*Revised Tijeras Arroyo Groundwater Current Conceptual Model and Corrective Measures Evaluation Report, Sandia National Laboratories, February 2018*).

The contaminants that remain at the Site are the result of a former leaking underground storage tank related to a remote fueling station. Six wells have shown various levels of petroleum contamination, including the presence of free product. The dissolved-phase plume is approximately 0.5 acres in size, and the free product impacts encompass an area of approximately 0.15 acres. The aquifer in this location within the granite 'bowl' feature is only approximately 10 feet thick, on overage, above the bedrock. The smaller area with free product is the focus of the pilot test injections. The surfactant and oxidant materials will be injected into the shallow

unconsolidated deposits from 55 to 65 feet bgs. These materials degrade readily in groundwater and will not migrate to the regional aquifer. The pilot test includes the following steps:

Step 1: E-Mulse 10 (manufactured by EthicalChem) surfactant solution (typically 2% to 6%) will be injected in wells RW-1 through RW-4 (500 to 750 gallons of surfactant per well). For the location, please see Figure 3-1 below. RW-1 is a 6-inch diameter recovery well, and RW-2 through RW-4 are 2-inch diameter recovery wells. After surfactant injection, clean water will be applied to wash surfactants through the formation and flush any surfactant that gets trapped in unsaturated pore spaces (2,500 to 3,000 gallons total into RW-1 through RW-4). A vacuum truck or equivalent with a stinger tube will be used recover fluids from the injection wells the day after injection. Recovered fluids will be transported and disposed of at an off-site approved wastewater disposal facility. Surfactant "breakthrough" and success in phase-separated hydrocarbons (PSH) recovery will be monitored by periodically examining test samples of effluent during vacuum truck extraction.

Step 2: After recovery of surfactant, groundwater and PSH from the four wells, Modified Fenton's Reagent (MFR) will be injected into recovery wells RW-1 through RW-4. In-Situ Oxidative Technologies, Inc.'s (ISOTEC) patented MFR oxidation process uses chelated ferrous iron (Fe^{+2}) catalyst and stabilized hydrogen peroxide (H_2O_2, commonly referred to as chelated hydrogen peroxide) for ISCO treatment of organic compounds in groundwater. ISOTEC will attempt to inject approximately 500 gallons of reagent at each IW location; this will consist of approximately 125 to 175 gallons of catalyst and approximately 250 to 350 gallons of oxidizer. The actual volume injected will depend upon the lithology, injection flow rate, delivery pressure, and occurrence of fluids appearing at the surface or flowing from nearby wells during injection.

For this Pilot Test, URS anticipates that single injection event may be utilized to demonstrate the effectiveness of the combined E-Mulse 10 and ISOTEC's MFR process for reducing the hydrocarbon contaminant mass sufficiently to attain and maintain target cleanup levels for contaminants in groundwater and residual PSH.

Injection Site Information

Depth to Ground Water: 64 to 66 ft below ground surface

Existing concentration of total dissolved solids (TDS) in ground water: 500 to 563 mg/L

Location: Kirtland Air Force Base, Site PL-567 Underground Storage Tank 58

County: Bernalillo

Latitude: 34°59'35.86"N

Longitude: 106°29'51.31"W

Map Showing Area of Injection Sites Attached (required) -: ☐

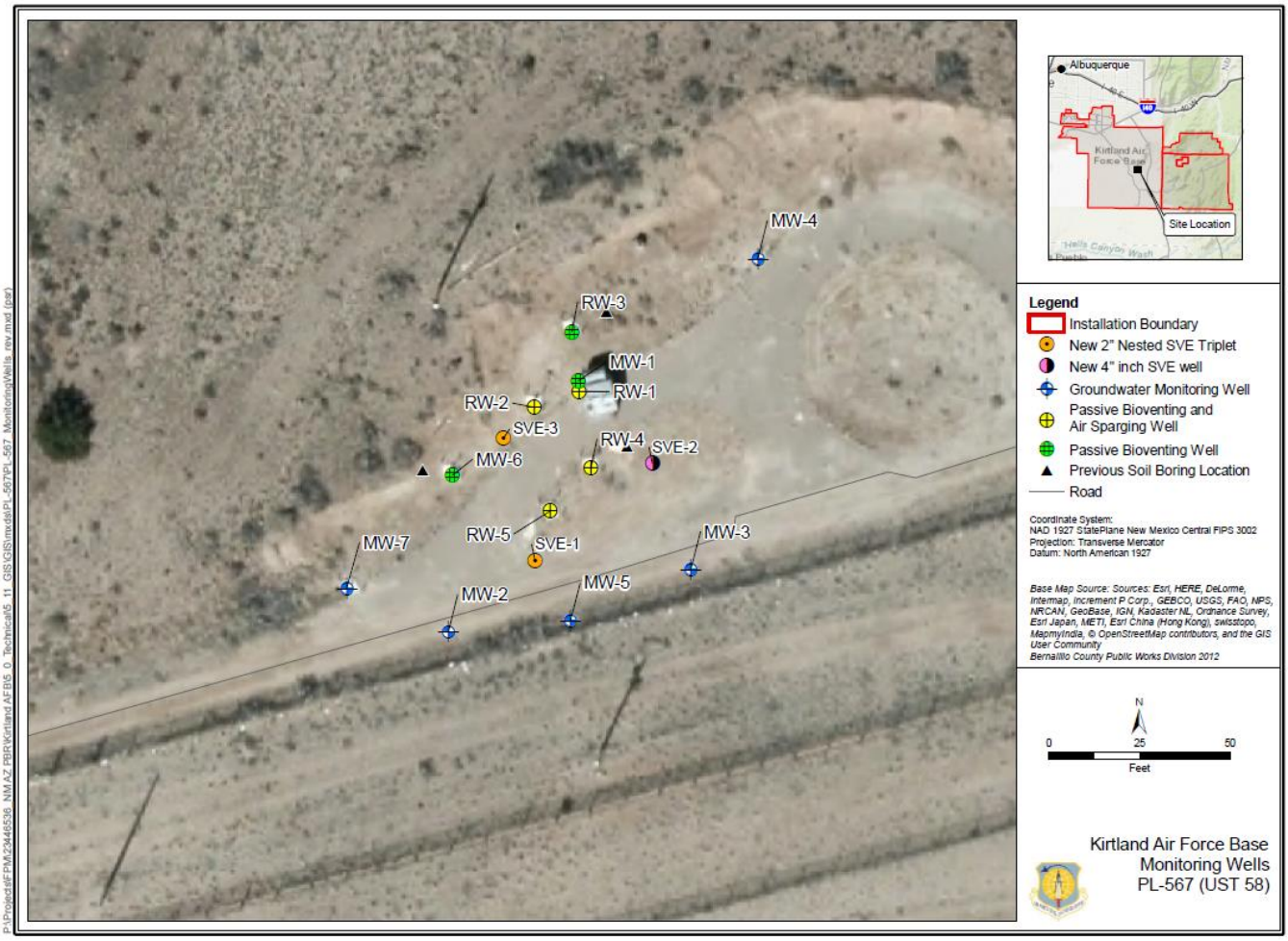

Figure 0-1. Site Layout Map

Additives Being Used (including volumes, manufacturer, and mixing ratios)

E-Mulse is a proprietary surfactant with 100% non-ionic surfactants by weight. E-Mulse 10 is a plant based biodegradable surfactant classified as readily biodegradable under the OECD 301 method. The pH of the E-Mulse 10 is 6.5. E-Mulse 10 does not have any known toxicity. Batch preparation methods will be used to prepare the surfactant in the field. Composite plastic tanks (50 to 300 gallons) will be used for blending and storage of the surfactant solution. For mixing and storage of the injectates or solutions to be injected, multiple tanks will be necessary to allow for the injection of a mixed batch and the concurrent mixing of additional batches. A minimum of two tanks will be used for surfactant preparation with one tank for mixing and the other tank for storage of the mixed solution. This ensures that sufficient injectate quantities are continuously available for injection.

Several batches of the surfactant solution will need to be prepared to inject the required surfactant volume. The solution will be mixed by circulating the required potable water volume with appropriate mass of surfactant. The initial required surfactant volume for all wells combined will be between 2,000 and 3,000 gallons (i.e., approximately 500 to 750 gallons per well), with the total volume injected depending on achievable rates of injection per well (i.e., tighter formations may prohibit the injection of the full volume). Internal components and hoses will be compatible with the surfactant. The surfactant delivery system will consist of a 2-inch double diaphragm pump, a PVC conveyance piping system, and a compression fitting coupler at the wellhead. The delivery system will be

equipped with double isolation valves (ball valves) at the storage tank discharge and check valves at the pump discharge. A mechanical flow meter and pressure gauge will be installed no less than 1.5 meter from the pump discharge point on the conveyance piping to monitor injection flow rates and pressure. All wells except RW-1 are 2-inch diameter wells. RW-1 is a 6-inch diameter well, and a downhole packer may be utilized to focus the injected surfactant in the PSH and smear zone.

Surfactant injection flow rates will be dependent on the actual permeability of the subsurface lithology and the rate at which the aquifer will accept an injected volume. Surfactant injection in the PSH source area will be performed in one injection event. During the injection process, injection flow rates and injection pressures will be recorded. If the injection rate becomes limited or the system pressure increases above 20 pounds per square inch (psi), the pumping rate will be reduced as needed to maintain a continuous injection flow rate and an injection pressure below 20 psi. If a continuous injection rate greater than 0.5 liters per minute cannot be maintained, surfactant injection should be discontinued temporarily (approximately 30 minutes) to allow dispersion of the surfactant. Groundwater levels and PSH thicknesses, if present, in nearby monitoring wells will be measured during injection to observe the aquifer's response to injection volumes under pressure. All surfactant injections at the four wells are anticipated to be completed in one to two days. The E-Mulse 10 surfactant is typically used at a concentration ranging from 2% to 6%. For the Pilot Test, an initial surfactant concentration of 3% will be used for injection.

Secondly, ISOTEC's Modified Fenton's Reagent (chelated ferrous iron (Fe+2) and H2O2 (commonly referred to as chelated hydrogen peroxide). Composition/information on MFR oxidant ingredients include amino poly carboxylate, iron chelate compound, inorganic phosphates, and hydrogen peroxide (maximum concentration is 30-34%). The peroxide is stabilized using ISOTEC proprietary Stabilizer-0875 powder, which consists of inorganic phosphates and is directly mixed with diluted peroxide.

ISOTEC's proprietary oxidizer consists of a pre-determined concentration of H2O2, water and stabilizer. ISOTEC will utilize an oxidizer concentration of 1.5 to 12%. The concentrated H2O2 shipped to the Site in drums will be diluted in plastic tanks (50 to 300 gallons) with water from the on-site water storage tank. The ISOTEC catalyst consists of a pH-buffered Fe+2 complex.

The dry catalyst will be mixed with water on-site in plastic tanks (50 to 300 gallons). The reaction can occur under natural pH conditions of the subsurface (i.e. pH 5 to 8) eliminating the need for pH adjustment required by traditional Fenton's reagent or base activated sodium persulfate. Following reaction of the iron catalyst solution in groundwater, iron concentrations initially may increase after injection, but then decrease to pre-remediation conditions after remediation, and the dissolved iron concentration is anticipated to be attenuate to background groundwater (i.e., milligrams per liter range) after injection. All reagents will be either injected during the mobilization or removed from the Site at the completion of each injection event. The oxidation reactions associated with Modified Fenton's Reagent can occur under natural pH conditions of the subsurface (i.e. pH 5 to 8), which eliminates the need for pH adjustment required by traditional Fenton's reagent or base activated sodium persulfate. The targeted pH range of the catalyst solution varies from 5.0-7.0. If required, pH adjustment can be performed by adjusting the ratio of chelated additives used in Modified Fenton's Reagent.

Peroxide dilution will be performed in a polyethylene tank with secondary containment. Water will be added to the dilution tank along with a dry stabilizer in a predetermined volume to create a 1.5 to 12% concentration (estimated) after the addition of a predetermined volume of H_2O_2. An electric

drum pump or an air operated double diaphragm pump will be used to transfer the peroxide into the dilution tank. Two technicians will be present on-site to complete this process. One technician operates the pump and the other holds the transfer wand in the dilution tank. Both technicians will wear splash resistant aprons, face-shields, and chemical resistant gloves while completing the chemical transfer.
Liquid catalyst, dry chemicals, and a polyethylene mixing tank will be stored inside of a box truck. To mix catalyst, iron will be added to the mixing tank followed by a predetermined quantity of water. An electric mixer is used to mix the solution. ISOTEC's patented chelating agents are then added to the solution and mixing continues. Although the chemicals are non-hazardous and the mixing process is generally dust free, the technician completing the mixing will wear nitrile gloves and a National Institute for Occupational Safety and Health approved N95 particulate respirator as a precautionary measure. Combustion issues associated with the presence of H_2O_2, a strong oxidizer, are minimized since a maximum solution of 30% will be delivered to the Site. The peroxide will be stored in DOT-approved 55-gallon drums. Flammable materials (i.e., gasoline) will not be stored near the peroxide or in locations where a peroxide spill could occur.

The ISOTEC reagents are not combined at the surface. The peroxide and catalyst only come into contact with one another in the subsurface. An additional precaution taken to prevented premature contact of these chemicals is to flush all equipment and the well casing with water between separate injections of each reagent.

Anticipated Precipitation, Dissolution, Adsorption, and Desorption Products

E-Mulse 10, emulsified or dispersed hydrocarbons, PSH

Modified Fenton's Reagent: water, oxygen and the iron catalyst is oxidized and precipitates out of solution.

Public Notice Posting Locations

2 inch by 3 inch Newspaper Ad required for New, Renewal, Modification and Renewal/Modification applications.
Newspaper: Albuquerque Journal – a display ad of at least 3 inches by 4 inches using wording provided by the NMED.

2 feet by 3 feet sign posted for 30 days in a location conspicuous to the public at or near the facility required for New, Modification and Renewal/Modification applications.
Sign Location: A 2 foot by 3 foot sign will be posted at the PL-567 site as well as posted at the Kirtland Air Force Base Truman Gate.

8.5 inch by 11 inch or larger posted off-site location conspicuous to the public (e.g. public library). Required for New, Modification and Renewal/Modification applications.
Flyer Location:

- Albuquerque Main Public Library, 501 Copper Ave NW, Albuquerque, NM
- South Valley Public Library, 3904 Isleta Blvd SW, Albuquerque, NM 87105
- San Pedro Public Library, 5600 Trumbull Ave SE, Albuquerque, NM 87108
- Ernie Pyle Public Library, 900 Girard Blvd SE, Albuquerque, NM 87106

This UIC Permit consists of the complete and accurate completion of this UIC Permit form as determined by the GWQB.

Issuance of this UIC Permit does not relieve the Permittee of the responsibility to comply with the WQA, WQCC Regulations, and any other applicable federal, state and/or local laws and regulations, such as zoning requirements and nuisance ordinances.

Signatures

Signature must be that of the person listed as the legally responsible party on this application.

I, the applicant, attest under penalty of law to the truth of the information and supporting documentation contained in this application for an Underground Injection Control General Discharge Permit.

Applicant's Signature

Signature: _____ Date: _____

Printed Name: _____ Title: _____

II. FINDINGS

In issuing this UIC Permit, GWQB finds:

1. The Permittee is injecting fluids so that such injections will move directly or indirectly into ground water within the meaning of Section 20.6.2.3104 NMAC.
2. The Permittee is injecting fluids so that such fluids will move into ground water of the State of New Mexico which has an existing concentration of 10,000 mg/L or less of TDS within the meaning of Subsection A of 20.6.2.3101 NMAC.
3. The Permittee is using a Class V UIC well as described in 20.6.2.5002(B)(5)(d)(ii) NMAC for in situ ground water remediation by injecting a fluid that facilitates vadose zone or groundwater remediation.
4. The Permittee is injecting fluids into groundwater in order to achieve the remediation goals identified in the Injection Plan.

III. AUTHORIZATION TO DISCHARGE

The Permittee is authorized to inject chemical additives into ground water in accordance with this UIC Permit and the Injection Plan under the oversight of the New Mexico Environment Department, Petroleum Storage Tank Bureau.

[20.6.2.3104 NMAC, Subsection C of 20.6.2.3106 NMAC, Subsection C of 20.6.2.3109 NMAC]

IV. CONDITIONS

The conditions of this UIC Permit shall be complied with by the Permittee and are enforceable by GWQB.

1. The Permittee shall perform remediation activities in accordance with the Injection Plan and shall notify GWQB of any changes prior to making them.

   [20.6.2.3107 NMAC]

2. The Permittee shall monitor the injection activities and their effects on ground water quality as required by the Injection Plan and shall provide GWQB with electronic copies of the required reporting and any pertinent documentation of activities at the site.

   [20.6.2.3107.A NMAC, 20.6.2.3109.A NMAC]

3. If the GWQB or the Permittee identifies any failure of the Injection Plan or this UIC Permit to comply with 20.6.2 NMAC not specifically noted herein, GWQB may require the Permittee to submit a corrective action plan and a schedule for completion of corrective actions to address the failure.

   Additionally, the GWQB may the Permittee to submit a proposed modification to the Injection Plan, this UIC Permit, or both.

   [20.6.2.3107.A NMAC, 20.6.2.3109.E NMAC]

4. ADDITIONAL MONITORING REQUIREMENTS – Prior to injecting and 30 days following injections, monitoring wells MW-1 thru MW-7 shall be sampled for the following:
   pH
   Oxidation Reduction Potential
   Dissolved Oxygen
   Total Dissolved Solids
   Sulfate
   Nitrate
   Zinc
   Arsenic
   Uranium
   Iron
   Manganese
   Chromium
   Chloride

   [Subsection A of 20.6.2.3107 NMAC]

5. TERMINATION – Within 30 days of completion of activities authorized by this UIC Permit the Permittee shall submit a closure report and a request to terminate the UIC Permit to the GWQB for its approval. The closure report shall identify how the injection well(s) was closed in accordance with the Injection Plan. The Permittee shall provide the Petroleum Storage Tank Bureau with a copy of this closure report.

   [20.6.2.5005 NMAC, 19.27.4 NMAC]

6. INSPECTION and ENTRY – The Permittee shall allow a representative of the NMED to inspect the facility and its operations subject to this UIC Permit and the WQCC regulations. The GWQB representative may, upon presentation of proper credentials, enter at reasonable times upon or through any premises in which a water contaminant source is located or in which are located any records required to be maintained by regulations of the federal government or the WQCC.

The Permittee shall allow the GWQB representative to have access to, and reproduce for their use, any copy of the records, and to perform assessments, sampling or monitoring during an inspection for the purpose of evaluating compliance with this UIC Permit and the WQCC regulations.

Nothing in this UIC Permit shall be construed as limiting in any way the inspection and entry authority of GWQB under the WQA, the WQCC Regulations, or any other local, state or federal regulations.

[20.6.2.3107.D NMAC, NMSA 1978, §§ 74-6-9.B and 74-6-9.E]

7. MODIFICATIONS and/or AMENDMENTS – In the event the Permittee proposes a change to the injection plan that would result in a change in the volume injected; the location of the injections; or the concentration of the additives being injected by the facility, the Permittee shall notify GWQB prior to implementing such changes. The Permittee shall obtain approval (which may require modification of this UIC Permit) by GWQB prior to implementing such changes.

   [20.6.2.3107.C NMAC, 20.6.2.3109.E and G NMAC]

8. COMPLIANCE with OTHER LAWS – Nothing in this UIC Permit shall be construed in any way as relieving the Permittee of the obligation to comply with all applicable federal, state, and local laws, regulations, permits or orders.

   [NMSA 1978, § 74-6-5.L]

9. PERMIT FEES – Payment of permit fees is due at the time of UIC Permit approval. Permit fees shall be paid in a single payment remitted to GWQB no later than 30 days after the UIC Permit effective date.

   Permit fees are associated with issuance of this UIC Permit. Nothing in this UIC Permit shall be construed as relieving the Permittee of the obligation to pay all permit fees assessed by GWQB. A Permittee that ceases injecting or does not commence injecting during the term of the UIC Permit shall pay all permit fees assessed by GWQB. An approved UIC Permit shall be suspended or terminated if the facility fails to remit a payment by its due date.

   [20.6.2.3114.F NMAC, NMSA 1978, § 74-6-5.K]